REMARKS

This application has been reviewed in light of the Office Action dated October 23, 2006. Claims 1-26 are pending in the application. No new matter has been added. The Examiner's reconsideration of the rejection in view of the amendment and the following remarks is respectfully requested.

By the Office Action, the Examiner warned that duplicate claims may exist and that should claims 1-10 be found to be allowable an objection to claims 11-17 (or vice versa) would be issued. It is respectfully submitted that claims 1 and 11 are not believed to be substantial duplicates of one another. However, should claim 1 or claim 11 be deemed allowable, the Applicant will consider canceling of one of the two sets of claims.

By the Office Action, claims 1-6, 10-12, 16-24 and 26 stand rejected under 35 U.S.C. §102(e) and §102(a) (PLEASE NOTE THE COMMON INVENTORS) as being anticipated by U.S. Patent Application Publication No. 2003/0172236 to Iyengar et al. (hereinafter Iyengar).

Claim 1 of the present invention, includes, *inter alia*, a method including maintaining information regarding which storage elements are storing particular objects in a consistency coordinator which communicates with the storage elements, responding to a request to update an object by using maintained information to determine which of the storage elements may store a copy of the object, instructing the storage elements, which the consistency coordinator suspects store a copy of the object, to invalidate their copy of the object, and performing an update of the object after each storage element that includes the copy of the object indicates that the storage element has invalidated the copy of the object or the storage

element is determined to be unresponsive.

Iyengar does not include a consistency coordinator. While Iyengar discloses a central cache, the central cache is not dedicated to maintaining information regarding which storage elements are storing particular objects. Instead, the central cache may include redundant information with the local caches. Should the information the central cache be updated, this information is sent to the local caches for updates. The central cache communicates with the local caches to coordinate this type of update. The central cache includes actual data content and is not a dedicated entity for maintaining information for all of the storage elements it serves.

Notwithstanding this, the present claims selectively target those storage elements that include an object to be updated by: "instructing the storage elements, which the consistency coordinator suspects store a copy of the object, to invalidate their copy of the object, and performing an update of the object after each storage element that includes the copy of the object indicates that the storage element has invalidated the copy of the object or the storage element is determined to be unresponsive". This is not taught in Iyengar.

The present steps provide for selective identification of which storage elements are updated. First, a limited number of storage elements are instructed by the consistency coordinator to invalidate and then only those that invalidated (or are unresponsive) are updated. There is no suggestion or equivalent recitation of these steps in Iyengar.

Note that the consistency coordinator instructs the storage elements to invalidate their copies of objects, e.g., "instructing the storage elements, which the consistency coordinator suspects store a copy of the object, to invalidate their copy of the object'. The

central cache of Iyengar does not instruct local caches to invalidate objects and then performs update. The Examiner states that the updating process includes invalidation. Even if, *arguendo*, this is true, Iyengar does not perform an update of the object after each storage element that includes the copy of the object indicates that the storage element has invalidated the copy of the object or the storage element is determined to be unresponsive. This feature of the present invention provides selective updating.

The present claims are directed to a strong consistency policy. It is therefore an aspect of the present claims to ensure that objects have consistency throughout a system. By employing a consistency coordinator the updating and invalidating are provided at a particular access point to ensure that strong consistency is maintained.

As part of this solution, the following steps are recited:

maintaining information regarding which storage elements are storing particular objects in a consistency coordinator which communicates with the storage elements,

responding to a request to update an object by using maintained information to determine which of the storage elements may store a copy of the object,

instructing the storage elements, which the consistency coordinator suspects store a copy of the object, to invalidate their copy of the object, and

performing an update of the object after each storage element that includes the copy of the object indicates that the storage element has invalidated the copy of the object or the storage element is determined to be unresponsive.

The central cache of Iyengar is simply an additional cache which is used to handle an update quickly. There is no instruction to the local caches to invalidate a copy of the

object, and if invalidated to report the invalidation to a consistency coordinator. In fact, the local caches may include a more up-to-date copy of the object than the central cache. This is because the local caches are also working independently of the central cache. This is supported and can readily be determined by referring to FIG. 2 of Iyengar. Blocks 204 and 208, show that the stored objects in the central cache can be different from the stored objects in a local cache.

In stark contrast, with reference to FIG. 1 of the present application, the consistency coordinator (12) receives update requests (from writers 14) and content (from content providers 16). Everything goes through the consistency coordinator 12 which maintains information for the storage elements of the system. Claim 1 includes maintaining information regarding which storage elements are storing particular objects in a consistency coordinator which communicates with the storage elements, responding to a request to update an object by using maintained information to determine which of the storage elements may store a copy of the object, instructing the storage elements, which the consistency coordinator suspects store a copy of the object, to invalidate their copy of the object, and performing an update of the object after each storage element that includes the copy of the object indicates that the storage element has invalidated the copy of the object or the storage element is determined to be unresponsive.

The coordinator in the present claims instructs storage elements that the coordinator suspects include a copy of the object to be updated to invalidate the storage element's copy. This is accurately performed since a complete set of information is maintained by the consistency coordinator. Then, for the storage elements that report that they invalidated their copy, the consistency coordinator updates the object. In this way, all versions of the object

are invalidated and only the storage elements that have invalidated a version of the object need to be updated. Hence, consistency is maintained in an efficient way without overburdening the system with unnecessary communications.

There is no teaching or suggestion in Iyengar of at least: instructing the storage elements, which the consistency coordinator suspects store a copy of the object, to invalidate their copy of the object, and performing an update of the object after each storage element that includes the copy of the object indicates that the storage element has invalidated the copy of the object or the storage element is determined to be unresponsive.

Iyengar does not explicitly disclose the need for strong consistency, and while the central cache provides some coordination for updates, the central cache does not provide an access point for all caches in a system so as to be able to provide the strong consistency provided by the present invention. The consistency coordinator knows what is stored by all of the storage elements, instructs those storage elements to invalidate their copy of an object and performs an update on those storage elements that have reported an invalidation. There is nothing in Iyengar that provides these steps.

Claims 10, 11, and 17 include similar recitations as claim 1. Since Iyengar fails to teach all of the elements of the present claims, claims 1, 10, 11, and 17 are believed to be in condition for allowance for at least the stated reasons. Reconsideration of the rejection is earnestly solicited.

Furthermore, claim 18 recites, *inter alia*, a system for maintaining strong data consistency comprising a plurality of storage elements, a consistency coordinator, which communicates with the plurality of storage elements and maintains information about which

objects are stored in the plurality of storage elements, the consistency coordinator providing selective communication to storage elements which include an object to be updated such that for a given object update the consistency coordinator communicates with only those storage elements which include the object to be updated.

Iyengar fails to disclose a consistency coordinator as defined in the present claims and specification. While the central cache of Iyengar includes directories of local caches, the central cache may or may not have information about what is actually stored in the local caches. The directories of the central cache may not have been updated in accordance with changes occurring locally in the local caches. In this way, the central cache can merely guess as to what is contained in a given local cache. See e.g., FIG. 2 in Iyengar.

However, the present claim 18 includes a consistency coordinator that maintains information about which objects are stored in the plurality of storage elements. The consistency coordinator provides selective communication to storage elements which include an object to be updated such that for a given object update the consistency coordinator communicates with only those storage elements which include the object to be updated. Such a feature is not suggested by Iyengar. Since the consistency coordinator includes all the information about what storage elements include which objects, the consistency coordinator can selectively communicate with those storage elements that actually include the object to be updated. For a given object update, the consistency coordinator communicates with only those storage elements that include the object to be updated. At least this feature is not taught by Iyengar.

Since Iyengar fails to teach the elements of the present claims, claim 18 is believed to be in condition for allowance for at least the stated reasons. In addition claims

dependent from claim 1, 11, and 18 are also believed to be in condition for allowance for at least the stated reasons. Reconsideration of the rejection is earnestly solicited.

The Examiner has made great efforts to further clarify his position, namely bolding claims language and making specific references to places in Iyengar. The Applicant appreciates the Examiner's efforts and thoroughness; however, the concepts presented in Iyengar and the present application are substantially different. While Iyengar provides a central cache to improve caching efficiency, the present claims are directed toward maintaining strong consistency in a memory system. The elements as set forth in the present claims provide for a completely different handling of information using a consistency coordinator to provide an access point to the storage elements. Further, the consistency coordinator instructs the storage elements which objects to invalidate. The storage elements respond and only those storage elements responding are updated by the consistency coordinator. Iyengar does not teach these features.

By the Office Action, claims 7-9, 14-15 and 25 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Iyengar in view of U.S. Application Patent No. 2005/0128960 to Chang et al. (hereinafter Chang).

Chang is cited to cure the deficiencies of Iyengar, namely with respect to heartbeat messages. While Change includes heartbeat messages, these messages are employed in a different way. For example, in claims 8 and 9, Chang does not disclose or suggest an entity that declares itself down in response to failing to receive a heart beat.

Chang fails to cure the deficiencies of Iyengar as set forth above. Further claims 7-9, 14-15 and 25 are dependent from independent claims which are believed to be in condition

for allowance and are therefore also believed to be allowable for at least the stated reasons. Reconsideration of the rejection is earnestly solicited.

It should be noted that the present application, Iyengar and Chang are all commonly assigned to the same entity, International Business Machines. The Applicant will consider filing a terminal disclaimer to overcome any obvious-type double patenting rejections. In any event, the Applicant believes that the prior art exclusion under §103(c) (MPEP 706.2) is applicable to one or more of the rejections made by the Examiner. Reconsideration is respectfully requested.

The Examiner is respectfully requested to call the undersigned after reviewing this document. It is believed that a verbal explanation of some of the concepts herein would be beneficial.

In view of the foregoing amendments and remarks, it is respectfully submitted that all the claims now pending in the application are in condition for allowance. Early and favorable reconsideration of the case is respectfully requested.

It is believed that no additional fees or charges are currently due. However, in the event that any additional fees or charges are required at this time in connection with the application, they may be charged to applicant's IBM Deposit Account No. 50-0510.

Respectfully submitted,

Date: 1/23/07

By: _____
James J. Bitetto
Registration No. 40,513

Mailing Address:

KEUSEY, TUTUNJIAN & BITETTO, P.C.
20 Crossways Park North, Suite 210
Woodbury, NY 11797
Tel: (516) 496-3868
Fax: (516) 496-3869